

REMARKS

Claims 1-2 and 4-23 are pending in the application.

Response to Claim Rejections Under 35 U.S.C. § 103(a)

A. Claims 1, 2 and 4-20 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mikoshiba et al. (U.S. Patent No. 6,384,321) in view of MacFarlane (“Ionic liquids based on imidazolium, ammonium, and pyrrolidinium salts of the dicyanamide ion”, Green Chemistry, 2002).

Applicants respectfully traverse.

Applicants respectfully disagree with the Examiner’s basis for rejection of the present claims as allegedly being obvious over the teachings of Mikoshiba and MacFarlane. As stated in §§ 2143.01(V) and (VI) of the MPEP, the proposed modification to a reference cannot render the invention disclosed in that reference unsatisfactory for its intended purpose, nor can a proposed modification change the principle of operation of the reference invention.

The electrolyte composition of Mikoshiba contains a substituted imidazolium iodide, a halogen-containing compound dissolved in the electrolyte, and a compound dissolved in the electrolyte and containing at least one element selected from N, P and S, the compound being capable of forming an onium salt with the halogen-containing compound. Based on the description at column 5, lines 26-63, the anion of the substituted imidazolium iodide participates in the reversible redox coupling in the electrolyte, along with the halogen containing compound. Accordingly, if the iodide compound is replaced with the dicyanamide compound of MacFarlane, as is asserted by the Examiner, the proposed modification would change the

principle of operation of the electrolyte composition of MacFarlane. Additionally, the dicyanamide cannot form an onium salt with the iodide compound.

Moreover, Applicants reiterate that there is no motivation to combine the inventions of Mikoshiba and MacFarlane because the former teaches the use of iodide and water in the electrolyte composition, whereas the latter teaches away from using iodide and water. Therefore, a combining the two would render the inventions unsatisfactory for their intended purposes.

Additionally, the presently claimed invention can achieve the following unexpected effects.

(1) Since an ionic liquid including dicyanoamide anions as the anions has lower viscosity than conventional ionic liquids, it can be expected that it will exhibit effects such as improving the rate of charge transfer in the electrolyte. See, for example, page 6, lines 19-21 of the specification.

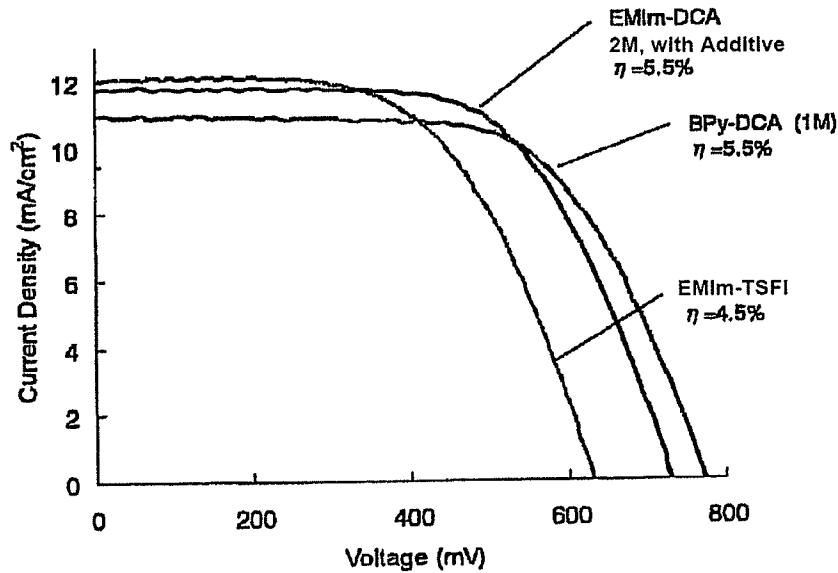
(2) Furthermore, the presently claimed electrolyte composition is beneficial in that a dye sensitizing solar cell using the electrolyte composition provides a higher electromotive force (open-circuit voltage) when compared with the case in which an ionic liquid is used. See, for example, page 6, lines 21-24 of the specification.

(3) Since the main component of the electrolyte composition is the ionic liquid including dicyanoamide anions as anions, it can achieve both a higher current characteristic and a higher voltage characteristic and therefore provides a better photoelectric conversion characteristic. See, for example, page 3, lines 18-20 and page 10, lines 8-12 of the specification.

Specifically, experimental data showing the unexpectedly superior properties of effect (3) discussed above, is shown below in Graph 1.

Graph 1 shows photoelectric conversion characteristic of the test cells EMIm-DCA (No. 1 at Table 1 of the specification), BPY-DCA (No. 3 at Table 1 of the specification), and EMIm-TFSI (No. 5 at Table 1 of the specification).

As shown in Graph 1, when the dicyanoamide anions is used as anions, i.e., EMIm-DCA and BPY-DCA, both short-circuit current density (J_{sc}) and open-circuit voltage (V_{oc}) are high, and excellent photoelectric conversion characteristic is observed. On the other hand, while a sulfonamide is used as anions, i.e., EMIm-TFSI, the open-circuit voltage (V_{oc}) becomes lower.



Graph 1

MacFarlane discloses that ionic liquid including dicyanoamide anions as anions has a low viscosity. Since the viscosity is low, the diffusion coefficient becomes higher. Therefore, one of

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ordinary skill in the art would expect that the current value would rise. However, as shown in Graph 1, the ionic liquid including dicyanoamide anions as anions has higher threshold value of the voltage for obtaining a current as compared with EMIm-TFSI.

As shown above, the ionic liquid including dicyanoamide anions as anions shows unexpected behaviors while used in a dye sensitizing solar cell, and superior effects such that both a higher current characteristic and a higher voltage characteristic can be achieved. As a result, a higher photoelectric conversion characteristic can be achieved.

In view of the above, Applicants respectfully traverse the § 103(a) rejection of claims 1, 2 and 4-20, and submit that the claims are patentable over Mikoshiba in view of MacFarlane. Accordingly, Applicants respectfully request reconsideration and withdrawal of the § 103(a) rejection.

B. Claims 21-23 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Mikoshiba et al. in view of MacFarlane et al. as applied to Claims 1, 2 and 5-20 above, and further in view of Koyanagi et al., U.S. Publication No. 2003/0150485.

Applicants respectfully traverse.

Claims 21-23 are patentable, at least by virtue of their dependence from claim 1, and because Koyanagi does not cure the above discussed deficiency in the combination of Mikoshiba and MacFarlane.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the §103(a) rejection of claims 21-23.

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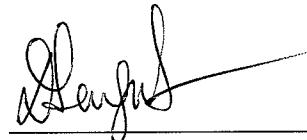
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Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Date: July 16, 2010